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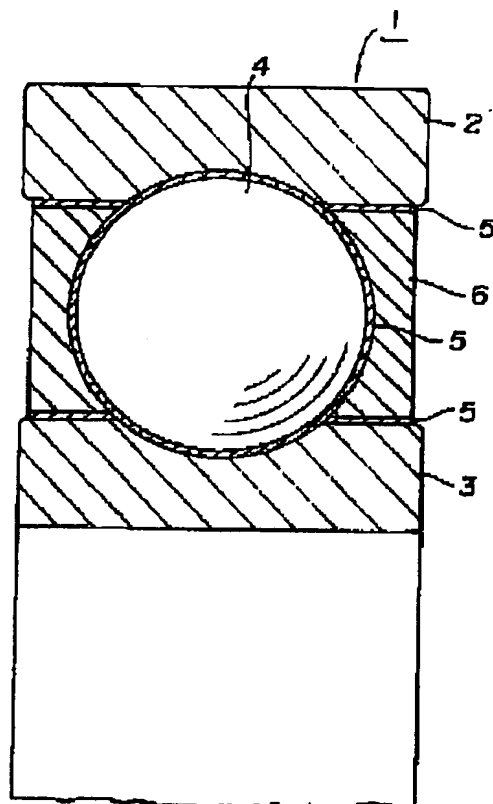
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TITLE : ROLLER BEARING FILLED WITH  
LUBRICANT CONTAINED POLYMER  
AND MANUFACTURE THEREOF



**ABSTRACT :** PROBLEM TO BE SOLVED: To ensure a smooth rotation irrespective of kinds of lubricant contained polymer to be filled by forming coating of solid lubricant at least on the inner circumferential surface of an outer ring and the outer circumferential surface of an inner ring and the surface of rolling bodies.

**SOLUTION:** A ball bearing 1 is assembled in its bearing by a conventional method, then, after degreasing and washing steps are performed, coating 5 composed of solid lubricant is formed on the inner circumferential surface of an outer ring 2, the outer circumferential surface of an inner ring 3, and the surface of a ball 4, and lubricant contained polymer 6 is filled in a space defined by the rings 2, 3 and the ball 4. As the solid lubricant polytetrafluoroethylene, graphite fluoride, or the like is for example used, through there is no special limitation to the selection while as the lubricant contained polymer 6 those composed of thermoplastic resin such as polyethylene, grease and lubricant are for example used, through there is no special limitation to the selection. With this constitution, the outer ring 2, the inner ring 3 and the ball 4 are not in contact with each other, and coating 5 prevents the intrusion of worn powder of lubricant polymer 6 into the gap therebetween, which worn powder is gradually separated by one rotation of the ball bearing 1 to contribute lubrication. Accordingly, the smooth ball rotation is ensured with low torque over a long period of time from the initial stage of operation.

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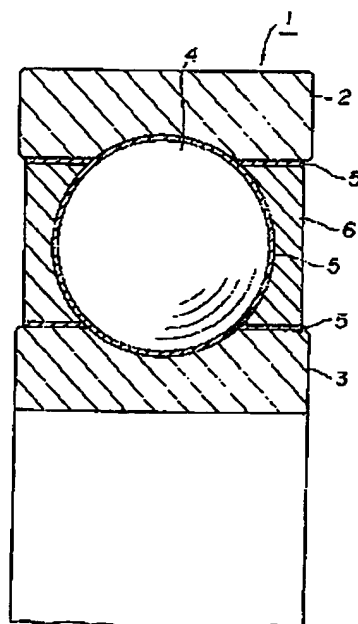
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(54) 【発明の名称】 潤滑剤含有ポリマ充填転がり軸受及びその製造方法

(57) 【要約】

【課題】 潤滑剤含有ポリマの種類に関係なく、円滑な回転を維持できる潤滑剤含有ポリマ充填転がり軸受を提供する。

【解決手段】 外輪2、内輪3及び転動体4により形成される空間内に潤滑剤含有ポリマ6を充填してなる転がり軸受1において、前記転がり軸受1の少なくとも外輪2の内周面、内輪3の外周面及び転動体4の表面に固体潤滑剤の被膜5が形成されていることを特徴とする潤滑剤含有ポリマ充填転がり軸受1。



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## 【特許請求の範囲】

【請求項1】 外輪、内輪及び転動体により形成される空間内に潤滑剤含有ポリマを充填してなる転がり軸受において、前記転がり軸受の少なくとも外輪の内周面、内輪の外周面及び転動体の表面に固体潤滑剤の被膜が形成されていることを特徴とする潤滑剤含有ポリマ充填転がり軸受。

【請求項2】 転がり軸受を組み立て、少なくとも外輪の内周面、内輪の外周面並びに転動体の表面に固体潤滑剤の被膜を形成し、次いで外輪、内輪及び転動体により形成される空間内に潤滑剤含有ポリマを充填し、固化させることを特徴とする潤滑剤含有ポリマ充填転がり軸受の製造方法。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、潤滑剤含有ポリマを充填した転がり軸受及びその製造方法に関する。

【0002】

【従来の技術】一般に、転がり軸受の外輪、内輪及び転動体の間の空間には、潤滑性を付与するために潤滑油やグリースが充填されている。しかし、これら潤滑油やグリースは液体または半固体状の物質であるため、軸受回転中に飛散したり流動化するのを防止するために必ずシール板等により密封されている。このため、小型の特殊軸受にはこれら潤滑剤やグリースを使用することが困難であった。

【0003】そこで、潤滑剤を含有するポリマを軸受の外輪、内輪及び転動体の間の空間に充填することが提案されており、例えば特公昭63-23239号公報には、グリースとポリエチレンとからなる潤滑剤含有ポリマ（プラスチックグリース）を軸受の外輪、内輪及び転動体からなる空間内に充填することが開示されている。この潤滑剤含有ポリマ充填転がり軸受では、潤滑剤含有ポリマが軸受の回転に伴ってその内部に取り込んだ潤滑成分であるグリースを徐放して、長期にわたる潤滑を維持する。しかし、この潤滑剤含有ポリマ充填転がり軸受では、特に、外輪と内輪との間の空間を転動体の占める空間を除いて全て埋めるように潤滑剤含有ポリマが充填された場合、潤滑剤含有ポリマが転動体の回転を阻害したり、また軸受の回転に伴って発生した潤滑剤含有ポリマの摩耗粉が転動体と内輪及び外輪との隙間に入り込んで所謂かみつき現象を起こしたり、軸受全体が振動したりして軸受としての機能が大きく低下することがあった。また、それに伴って軸受の温度上昇を起こすこともあった。

【0004】このような問題を解決するために、特開平8-312652号公報では、保持器と転動体との間に潤滑剤含有ポリマの潤滑成分の被膜を形成することにより、潤滑剤含有ポリマと転動体との直接接触を回避することを提案している。

【0005】

【発明が解決しようとする課題】しかしながら、前記潤滑剤含有ポリマの潤滑成分の被膜を形成した転がり軸受においても、以下のような問題があった。即ち、潤滑剤含有ポリマ充填転がり軸受は、通常、潤滑剤含有ポリマを外輪、内輪及び転動体により形成される空間内に充填し、固化して得られるが、その際に未凝成の潤滑剤含有ポリマを固化する場合には、潤滑剤含有ポリマを構成する熱可塑性樹脂（例えば、ポリエチレン）の融点以上にして未凝成の潤滑剤含有ポリマを融解させる必要がある。しかし、この融解時には、樹脂と潤滑剤とは相溶した状態になっており、樹脂は他の成分を最も取り込みやすい状態となっている。従って、このような状態では転動体等の表面に成膜された潤滑成分もこの溶融した樹脂に取り込まれてしまい、潤滑剤含有ポリマが転動体に接触するようにして固化する可能性が高くなり、それによって転動体の回転が拘束され、潤滑成分の被膜によるトルク低減効果があまり発揮されない場合がでてくる。

【0006】そこで、本発明は上記の問題点を解決することを目的とし、即ち潤滑剤含有ポリマの槽類に関係なく、円滑な回転を維持できる潤滑剤含有ポリマ充填転がり軸受を提供すること、並びにその製造方法を提供することを目的とする。

【0007】

【課題を解決するための手段】上記の目的を達成するために、本発明は、外輪、内輪及び転動体により形成される空間内に潤滑剤含有ポリマを充填してなる転がり軸受において、前記転がり軸受の少なくとも外輪の内周面、内輪の外周面及び転動体の表面に固体潤滑剤の被膜が形成されていることを特徴とする。また、同様の目的を達成するために、本発明は、転がり軸受を組み立て、少なくとも外輪の内周面、内輪の外周面並びに転動体の表面に固体潤滑剤の被膜を形成し、次いで外輪、内輪及び転動体により形成される空間内に潤滑剤含有ポリマを充填し、固化させることを特徴とする。

【0008】

【発明の実施の形態】以下、本発明に関して図面を参照して詳細に説明する。図1は、本発明に係る潤滑剤含有ポリマ充填転がり軸受の一実施形態である玉軸受を示す要部断面図である。図示されるように、玉軸受1は外輪2の内周面、内輪3の外周面並びに転動体である玉4の表面に、固体潤滑剤からなる被膜5が成膜されており、更にこれら固体潤滑剤被膜5が成膜された外輪2、内輪3及び玉4により形成される空間内に潤滑剤含有ポリマ6が充填されている。従って、潤滑剤含有ポリマ6は、固体潤滑剤被膜5の存在により外輪2、内輪3並びに玉4と直接接することがなくなり、玉4等の回転を阻害することがない。また、固体潤滑剤被膜5は、玉4と外輪2及び内輪3との隙間にも形成されるため、これらの隙間に潤滑剤ポリマ6の摩耗粉が入り込むのを防止す

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る。更に、固体潤滑剤被膜5は玉軸受1の回転に伴って徐々に剥がれて潤滑に寄与し、特に運転初期における潤滑性を向上させる。その際、固体潤滑剤被膜5が剥離した後も、潤滑剤含有ポリマ6と玉軸受1の構成部位との間に、固体潤滑剤被膜5の成膜当初の膜厚に相当する隙間が維持され、潤滑剤含有ポリマ6と玉軸受1の構成部位とは直接接することがない。また、潤滑剤含有ポリマ6は、玉軸受1の回転に伴ってその内部に取り込んだ潤滑成分を徐放して、長期にわたる潤滑を維持する。このように、固体潤滑剤被膜5が潤滑剤含有ポリマ6と玉軸受1の構成部位との間に介在することにより、玉軸受1にその運転初期から長期にわたり低トルクで、円滑な回転を行わせることができる。

【0009】固体潤滑剤被膜5の膜厚は、0.1  $\mu\text{m}$  ~ 100  $\mu\text{m}$ 、好ましくは0.1  $\mu\text{m}$  ~ 30  $\mu\text{m}$ である。固体潤滑剤被膜5の膜厚が0.1  $\mu\text{m}$ 未満では、潤滑剤含有ポリマ6と外輪2、内輪3及び玉4との接触を防止する作用、並びに固体潤滑剤が本来有する潤滑作用が充分に発現しない。一方、100  $\mu\text{m}$ を越す膜厚の場合には、前記隙間に潤滑剤含有ポリマ6の摩耗粉が入り込みやすくなる。

【0010】本発明で使用できる固体潤滑剤は特に制限されるものではないが、ポリテトラフルオロエチレン（PTFE）、 $\text{MoS}_2$ 、グラファイト、N-ラウロイル-L-リジン、 $\text{h-BN}$ 、フッ化黒鉛等があり、中でも成膜することで油性が大きくなるPTFE、フッ化黒鉛が特に好適である。また、これらの固体潤滑剤は、成膜に際して水、キシレン、ミネラルスピリット、イソプロピルアルコール、トルエン、酢酸ブチル、メタノール、エチレングリコール、低沸点パーフルオロカーボン（具体的にはパーフルオロペンタン、パーフルオロヘキサエン等）などの分散媒中に分散したものが使用される。尚、成膜の容易性を考慮すると、分散媒としてはこの中で沸点が70℃以下のものが好適である。固体潤滑剤の分散液の具体例としては、（株）多村のPTFE分散液KDシリーズ、（株）オーデックの $\text{h-BN}$ （+有機バインダー）分散液-ホワイティシリーズ、日本潤滑剤（株）のWS、（+アクリル系有機統合剤）分散液タンミックボンダーA等を挙げることができる。

【0011】潤滑剤含有ポリマとしては、特に制限はないが、具体的にはポリエチレンなどの熱可塑性樹脂とグリース・潤滑油とからなるものが挙げられ、また、ジアリルフタレート、ポリウレタン、ポリノルボルネンなどとグリース・潤滑油とからなる熱で硬化あるいは架橋するもの等も使用することができる。

【0012】上記の玉軸受1は、通常の方法により軸受を組み立て、脂洗浄した後、固体潤滑剤被膜5を成膜し、次いで潤滑剤含有ポリマ6を充填、固化させる工程から構成される。固体潤滑剤被膜5の形成は、上記した固体潤滑剤を上記した分散媒に分散した懸濁液に玉軸受

1を浸漬するか、あるいは同懸濁液を外輪2の内周面、内輪3の外周面並びに玉4の端面に噴霧した後、懸濁液の分散媒を蒸発させることによって行う。その際、固体潤滑剤被膜5の厚さが上記した膜厚となるように、懸濁液の濃度、固体潤滑剤の平均粒子径、浸漬又は噴霧時間を調整して行う。

【0013】固体潤滑剤被膜5を成膜した後、上記した樹脂と潤滑成分とを混練してなるゲル状またはペースト状の潤滑剤含有ポリマ6を玉軸受1の外輪2、内輪3及び玉4により形成される空間内に充填し、次いで玉軸受1ごと加熱してポリマを前記空間内で固化させ、玉軸受1内に保持させる。この時の温度や加熱時間等はポリマの種類により異なり、適宜選択される。潤滑剤含有ポリマ6を充填する方法には特に制限はないが、例えば特開平8-309793号公報に記載の射出成形機を好適に使用することができる。その後、自然冷却して潤滑剤含有ポリマを充填した玉軸受が得られる。

【0014】本発明の潤滑剤含有ポリマ充填軸受は、図1に示した玉軸受1の他に、図2に示すような自動調心ころ軸受11にも適用することができる。この自動調心ころ軸受11は、転動体であるころ14が調心可能な構造となっており、それに伴い軸受全体として調心可能な構造となっている。具体的に説明すると、この自動調心ころ軸受11は内輪13と外輪12との間に2列に、かつ径方向に互い違いに配置された轉型のころ14を一体型に構成された保持器17により保持し、更に保持器17と内輪13との間にころ14を案内する案内輪18が該保持器17と同心状に配置して構成されている。また、内輪13の外周面と外輪12の内周面、ころ14及び案内輪18の表面には固体潤滑剤被膜15が成膜されており、更に内輪13と外輪12との間に存在する空隙、内輪13ところ14の外端面との間の空隙及びころ14の内端面と案内輪18との間の空隙には、潤滑剤含有ポリマ16がそれぞれ充填されている。

【0015】上記した自動調心ころ軸受11においては、ころ14の内端面が案内輪18とすべり接触して軸受トルクの上昇や軸受の温度上昇が起こる。しかし、本発明ではころ14及び案内輪18の表面に固体潤滑剤被膜15が成膜されているために、この接触抵抗が低減されて軸受トルクの上昇や軸受の温度上昇を効果的に抑制できる。

【0016】

【実施例】以下、実施例により本発明をより明確にする。但し、本発明は本実施例に限定されるものではない。

（実施例及び比較例）図2に示す自動調心ころ軸受（呼び番号：22311）を脂洗浄後、PTFE懸濁液（（株）多村：KD-400AS（PTFE中心粒径：0.3  $\mu\text{m}$ 、PTFE濃度：10%、分散媒：パーフルオロペンタン））に浸漬し、その後自然乾燥してP

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TFEの被膜を成膜した。膜厚は、1～5  $\mu\text{m}$ であった。次いで、潤滑剤含有ポリマとして以下の配合のものを特開平8-309793号公報に記載の含油ポリマ成形用の射出成形機を用いて外輪、内輪、ころ及び案内輪により形成される軸受の内部空間に充填した。潤滑剤含有ポリマ部材：

高密度ポリエチレン	20wt%
超高分子量ポリエチレン	5wt%
ポリエチレンワックス	5wt%
鉱油	70wt%

また、比較のために上記自動調心ころ軸受においてPTFEの被膜を成膜することなく、上記の潤滑剤含有ポリマ部材を充填した。

【0017】以上の操作によって得られた各自動調心ころ軸受について、回転試験（ $N=800\text{rpm}$ 、 $F_r=280\text{kgf}$ ）を行い、外輪外径温度と軸受トルクを測定した。結果を表1に示す。

【0018】

【表1】

表1

試験軸受	実施例	比較例
外輪外径温度（℃）	46	62
軸受トルク（ $\text{kgf} \cdot \text{cm}$ ）	1.3	6.4

【0019】表1の結果から明らかなように、実施例の軸受においては転動体の表面、内輪の外周面及び外輪の内周面にPTFEの被膜が形成されているため、軸受の部位と潤滑剤含有ポリマとが直接接することがなく、比較例の軸受に比べて軸受トルクが小さくなり、それによって軸受の温度上昇も低く抑えられていることがわかる。また、案内輪の表面にもPTFEの被膜が形成されているため、同じくPTFEの被膜が形成されている転動体の内周面との間の潤滑が安定に保たれ、これも軸受トルクの低減につながっているものと考えられる。

【0020】

【発明の効果】以上説明したように、本発明によると、固体潤滑剤の被膜が軸受の各部位（内輪の外周面側、外輪の内周面側、転動体の表面等）に形成されているため、この被膜の厚さ分だけ軸受の各部位と潤滑剤含有ポリマとの間に隙間が形成されているのと同等となるのと同時に固体潤滑剤の潤滑作用が付加される。従って、潤滑剤含有ポリマの摩耗粉のかみ付きによる軸受の回転不良や、潤滑剤含有ポリマと軸受の各部位との間の摩擦も少なくなり、トルク上昇や軸受の温度上昇も最小限に抑えられ、低トルクでスムーズが軸受の回転を維持できる。また、それと同時に、潤滑剤含有ポリマから徐放される潤滑剤によって安定した潤滑も維持される。また、製造方法においても、潤滑剤含有ポリマを充填する前に固体潤滑剤を含む懸濁液を塗工後放置する等の簡単な処理で固体潤滑剤被膜を形成でき、特に作業工程に支障を来すことなく作製することができる。

【図面の簡単な説明】

【図1】本発明に係る潤滑剤含有ポリマ充填転がり軸受の一実施形態（玉軸受）を示す要部断面図である。

【図2】本発明に係る潤滑剤含有ポリマ充填転がり軸受の他の実施形態（自動調心ころ軸受）を示す要部断面図である。

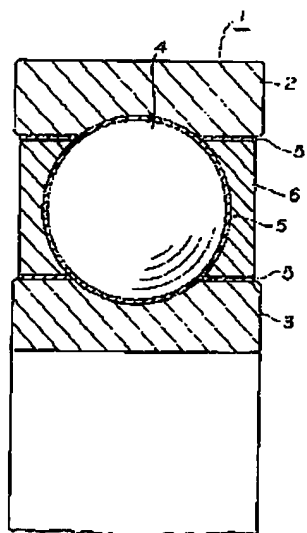
【符号の説明】

- 1 玉軸受
- 2 外輪
- 3 内輪
- 4 玉
- 5 固体潤滑剤含有被膜
- 6 潤滑剤含有ポリマ
- 7 保持器
- 11 自動調心ころ軸受
- 12 外輪
- 13 内輪
- 14 ころ
- 15 固体潤滑剤含有被膜
- 16 潤滑剤含有ポリマ
- 17 保持器
- 18 案内輪

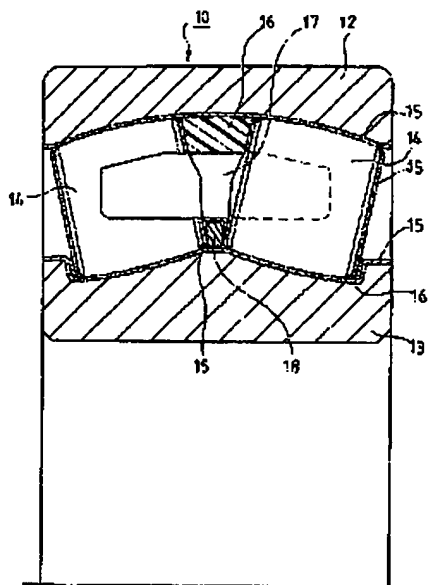
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特開平11-51066

【図1】



【図2】



特開平 11-51066

【公報種別】特許法第17条の2の規定による補正の掲載

【部門区分】第5部門第2区分

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【手続補正書】

【提出日】平成14年11月5日(2002. 11. 5)

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】特許請求の範囲

【補正方法】変更

【補正内容】

【特許請求の範囲】

【請求項1】 外輪、内輪及び転動体により形成される空間内に潤滑剤含有ポリマを充填してなる転がり軸受において、前記転がり軸受の少なくとも外輪の内周面、内輪の外周面及び転動体の表面に固体潤滑剤の被膜が形成されていることを特徴とする潤滑剤含有ポリマ充填転がり軸受。

【請求項2】 固体潤滑剤の被膜の膜厚が0.1～100μmであることを特徴とする請求項1記載の潤滑剤含有ポリマ充填転がり軸受。

【請求項3】 固体潤滑剤がポリテトラフルオロエチレ

ン、MoS<sub>2</sub>、グラファイト、N-ラウロイルレリジン、h-BNまたはフッ化黒鉛であることを特徴とする請求項1または2記載の潤滑剤含有ポリマ充填転がり軸受。

【請求項4】 転がり軸受を組み立て、少なくとも外輪の内周面、内輪の外周面並びに転動体の表面に固体潤滑剤の被膜を形成し、次いで外輪、内輪及び転動体により形成される空間内に潤滑剤含有ポリマを充填し、固化させることを特徴とする潤滑剤含有ポリマ充填転がり軸受の製造方法。

【請求項5】 固体潤滑剤の被膜を、ポリテトラフルオロエチレン、MoS<sub>2</sub>、グラファイト、N-ラウロイルレリジン、h-BNまたはフッ化黒鉛を分散媒に分散した懸濁液に軸受を浸漬した後、または前記懸濁液を外輪の内周面、内輪の外周面並びに転動体表面に噴霧した後、懸濁液の分散媒を蒸発させて形成することを特徴とする請求項4記載の潤滑剤含有ポリマ充填転がり軸受の製造方法。

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CLAIMS

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[Claim(s)]

[Claim 1] Lubricant content polymer restoration anti-friction bearing characterized by the thing of said anti-friction bearing for which the coat of a solid lubricant is formed in the inner skin of an outer ring of spiral wound gasket, the family peripheral face, and the front face of a rolling element at least in anti-friction bearing which comes to fill up a lubricant content polymer in the space formed with an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and a rolling element.

[Claim 2] The manufacture approach of lubricant content polymer restoration anti-friction bearing which is filled up with a lubricant content polymer in the space which forms anti-friction bearing in the inner skin of an outer ring of spiral wound gasket, and a family peripheral face list, forms the coat of a solid lubricant on the surface of a rolling element at least after assembly, and is subsequently formed with an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and a rolling element, and is characterized by making it solidify.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to anti-friction bearing filled up with the lubricant content polymer, and its manufacture approach.

[0002]

[Description of the Prior Art] Generally, the space between the outer ring of spiral wound gasket of anti-friction bearing, an inner ring of spiral wound gasket, and a rolling element is filled up with a lubricating oil or grease in order to give lubricity. However, these lubricating oils and grease are surely sealed with the seal plate etc., in order to disperse during a bearing revolution since it is the matter of the shape of a liquid or a semisolid, or to prevent fluidizing. For this reason, it was difficult for small special bearing to use these lubricant and grease.

[0003] Then, being filled up with the lubricant content polymer (plastics grease) to which filling up the space between the outer ring of spiral wound gasket of bearing, an inner ring of spiral wound gasket, and a rolling element with the polymer containing lubricant is proposed, for example, it becomes JP,63-23239,B from grease and polyethylene in the space which consists of the outer ring of spiral wound gasket, inner ring of spiral wound gasket, and rolling element of bearing is indicated. In this lubricant content polymer restoration anti-friction bearing, the grease which is the lubrication component which the lubricant content polymer incorporated to that interior with the revolution of bearing is released gradually, and the lubrication over a long period of time is maintained. however, in this lubricant content polymer restoration anti-friction bearing When it fills up with a lubricant content polymer so that the space between an outer ring of spiral wound gasket and an inner ring of spiral wound gasket may be especially filled altogether except for the space which a rolling element occupies, The lubricant content polymer checked the revolution of a rolling element, and the wear powder of a lubricant content polymer generated with the revolution of bearing entered the clearance between a rolling element, an inner ring of spiral wound gasket, and an outer ring of spiral wound gasket, and there was the so-called thing [ that are attached, and cause a phenomenon, or the whole bearing vibrates / bite, and /, and the function as bearing falls greatly ]. Moreover, the temperature rise of bearing might be caused in connection with it.

[0004] In order to solve such a problem, in JP,8-312652,A, it has proposed avoiding the direct contact to a lubricant content polymer and a rolling element by forming the coat of the lubrication component of a lubricant content polymer between a cage and a rolling element.

[0005]

[Problem(s) to be Solved by the Invention] However, there were the following problems also in anti-friction bearing in which the coat of the lubrication component of said lubricant content polymer was formed. That is, although it is usually filled up with a lubricant content polymer in the space formed with an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and a rolling element, it solidifies and it is obtained, when solidifying a non-calcinated lubricant content polymer in that case, it is necessary to carry out lubricant content polymer restoration anti-friction bearing more than the

melting point of the thermoplastics (for example, polyethylene) which constitutes a lubricant content polymer, and it needs to dissolve a non-calcinated lubricant content polymer. However, at the time of this fusion, resin and lubricant will be dissolved and resin is in the condition of being the easiest to incorporate other components. Therefore, in such the condition, it will be incorporated by this fused resin, and possibility that it will solidify to it as a lubricant content polymer contacts a rolling element becomes high, a revolution of a rolling element is restrained by it, and the case where the torque reduction effectiveness by the coat of a lubrication component is seldom demonstrated comes also out of the lubrication component formed by front faces, such as a rolling element.

[0006] Then, this invention aims at offering lubricant content polymer restoration anti-friction bearing which can maintain a smooth revolution regardless of the class of lubricant content polymer for the purpose of solving the above-mentioned trouble, and providing a list with the manufacture approach.

[0007]

[Means for Solving the Problem] In order to attain the above-mentioned object, this invention is characterized by the thing of said anti-friction bearing for which the coat of a solid lubricant is formed in the inner skin of an outer ring of spiral wound gasket, the family peripheral face, and the front face of a rolling element at least in anti-friction bearing which comes to fill up a lubricant content polymer in the space formed with an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and a rolling element. Moreover, in order to attain the same object, this invention is filled up with a lubricant content polymer in the space which anti-friction bearing is formed in the inner skin of an outer ring of spiral wound gasket, and a family peripheral face list, it forms the coat of a solid lubricant on the surface of a rolling element at least after assembly, and is subsequently formed with an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and a rolling element, and is characterized by making it solidify.

[0008]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail with reference to a drawing. Drawing 1 is the important section sectional view showing the ball bearing which is 1 operation gestalt of lubricant content polymer restoration anti-friction bearing concerning this invention. It fills up with the lubricant content polymer 6 in the space in which a ball bearing 1 is formed with the outer ring of spiral wound gasket 2, the inner ring of spiral wound gasket 3, and ball 4 with which the coat 5 which consists of a solid lubricant is formed by the inner skin of an outer ring of spiral wound gasket 2, and the peripheral face list of an inner ring of spiral wound gasket 3 on the front face of the ball 4 which is a rolling element, and these solid lubricant coat 5 was formed further so that it may be illustrated. Therefore, contacting an outer ring of spiral wound gasket 2 and inner-ring-of-spiral-wound-gasket 3 list of the lubricant content polymer 6 a ball 4 and directly by existence of the solid lubricant coat 5 is lost, and it does not check the revolution of ball 4 grade. Moreover, since the solid lubricant coat 5 is formed also in the clearance between a ball 4, an outer ring of spiral wound gasket 2, and an inner ring of spiral wound gasket 3, it prevents that the wear powder of the lubricant polymer 6 enters these clearances. Furthermore, it separates gradually with the revolution of a ball bearing 1, and contributes to lubrication, and the solid lubricant coat 5 raises the lubricity especially in the early stages of operation. Even after the solid lubricant coat 5 exfoliates in that case, the clearance which corresponds between the lubricant content polymer 6 and the configuration part of a ball bearing 1 at the thickness of the time of membrane formation of the solid lubricant coat 5 is maintained, and the lubricant content polymer 6 and the configuration part of a ball bearing 1 do not contact directly. Moreover, the lubricant content polymer 6 releases gradually the lubrication component incorporated to the interior with the revolution of a ball bearing 1, and maintains the lubrication over a long period of time. Thus, a smooth revolution can be made to perform to a ball bearing 1 with rear-spring-supporter low torque from the early stages of operation at a long period of time, when the solid lubricant coat 5 intervenes between the lubricant content polymer 6 and the configuration part of a ball bearing 1.

[0009] 0.1 micrometers - 100 micrometers of thickness of the solid lubricant coat 5 are 0.1 micrometers - 30 micrometers preferably. The operation to which the thickness of the solid lubricant coat 5 prevents contact to the lubricant content polymer 6, an outer ring of spiral wound gasket 2, an inner ring of spiral

wound gasket 3, and a ball 4 in less than 0.1 micrometers, and the lubrication action which a solid lubricant originally has in a list are not fully discovered. On the other hand, in the case of the thickness which exceeds 100 micrometers, the wear powder of the lubricant content polymer 6 becomes easy to enter said clearance.

[0010] Although especially the solid lubricant that can be used by this invention is not restricted, especially the PTFE and graphite fluoride with which \*\*\*\*\* becomes large by there being polytetrafluoroethylene (PTFE), MoS<sub>2</sub>, graphite, N-lauroyl L-lysine, h-BN, graphite, etc. fluoride, and forming membranes also in it are suitable. Moreover, what distributed these solid lubricants on the occasion of membrane formation in dispersion media (specifically a perfluoro pentane, a perfluoro hexane, etc.), such as water, a xylene, mineral SUPRIDDO, isopropyl alcohol, toluene, butyl acetate, a methanol, ethylene glycol, and low-boiling point perfluorocarbon, is used. In addition, if the ease of membrane formation is taken into consideration, as a dispersion medium, the boiling point is suitable for a thing 70 degrees C or less in this. As an example of the dispersion liquid of a solid lubricant, it is WS2 of Kitamura's PTFE dispersion-liquid KD series, the h-BN (+ organic binder) dispersion-liquid-HOWAI tee series of ODEKKU, and Japanese Lubricant. Dispersion-liquid (+ acrylic organic integrated agent) tongue MIKKUBONDOA etc. can be mentioned.

[0011] As a lubricant content polymer, although there is especially no limit, what hardens or constructs a bridge with the heat what specifically consists of thermoplastics, and grease and lubricating oils, such as polyethylene, is mentioned, and it is indifferent from diallyl phthalate, polyurethane, poly norbornene, etc. and grease and a lubricating oil can be used.

[0012] After the above-mentioned ball bearing 1 assembles bearing by the usual approach and carries out cleaning washing, it forms the solid lubricant coat 5 and consists of processes which subsequently fill up with and solidify the lubricant content polymer 6. Formation of the solid lubricant coat 5 is performed by evaporating the dispersion medium of suspension, after immersing a ball bearing 1 in the suspension distributed to the dispersion medium which described the above-mentioned solid lubricant above or spraying this suspension on the front face of a ball 4 at the inner skin of an outer ring of spiral wound gasket 2, and the peripheral face list of an inner ring of spiral wound gasket 3. In that case, it carries out by adjusting the concentration of suspension, the mean particle diameter of a solid lubricant, immersion, or fuel-spray time amount so that it may become the thickness which the thickness of the solid lubricant coat 5 described above.

[0013] After forming the solid lubricant coat 5, it is filled up with the lubricant content polymer 6 of the shape of the gel which comes to knead the above-mentioned resin and a lubrication component, or a paste in the space formed with the outer ring of spiral wound gasket 2, the inner ring of spiral wound gasket 3, and ball 4 of a ball bearing 1, and subsequently it heats the whole ball bearing, a polymer is solidified in said space, and it is made to hold in a ball bearing 1. Temperature, heating time, etc. at this time change with classes of polymer, and are chosen suitably. Although there is especially no limit in the approach filled up with the lubricant content polymer 6, the injection molding machine of a publication can be suitably used, for example for JP,8-309793,A. Then, the ball bearing which cooled naturally and was filled up with the lubricant content polymer is obtained.

[0014] Lubricant content polymer restoration anti-friction bearing of this invention is applicable also to the self-aligning roller bearing 11 as shown in drawing 2 other than the ball bearing 1 shown in drawing 1. When this self-aligning roller bearing 11 is a rolling element, it has the structure where 14 can be aligned, and it has the structure where it can align as the whole bearing, in connection with it. if it explains concretely -- this self-aligning roller bearing 11 -- between an inner ring of spiral wound gasket 13 and outer rings of spiral wound gasket 12 -- two trains -- and the cage 17 constituted by one apparatus in 14 at the slack [ which has been alternately arranged in the direction of a path ] type time -- holding -- further -- between a cage 17 and inner rings of spiral wound gasket 13 -- time -- 14 -- showing around -- a floating guide ring -- 18 -- this -- it arranges cage 17 and in the shape of a said alignment, and is constituted. Moreover, the solid lubricant coat 15 is formed by the front face of 14 and a floating guide ring 18 at the peripheral face of an inner ring of spiral wound gasket 13, the inner skin of an outer ring of spiral wound gasket 12, and the time, and the gap between the inner end face of 14 and a floating

guide ring 18 is filled up with the lubricant content polymer 16, respectively at the gap between the outer edge surfaces of 14, and the time at the dead air space and the inner ring of spiral wound gasket 13 which exist further between an inner ring of spiral wound gasket 13 and an outer ring of spiral wound gasket 12, and the time.

[0015] In the above-mentioned self-aligning roller bearing 11, the inner end face of a roller 14 carries out sliding contact to a floating guide ring 18, and lifting of bearing torque and the temperature rise of bearing happen. However, in this invention, since the solid lubricant coat 15 is formed by the roller 14 and the front face of a floating guide ring 18, this contact resistance is reduced and lifting of bearing torque and the temperature rise of bearing can be controlled effectively.

[0016]

[Example] Hereafter, this invention is clarified more according to an example. However, this invention is not limited to this example.

(An example and example of a comparison) It was immersed in PTFE suspension [Kitamura:KD-400AS (the diameter of a PTFE centriole: 0.3-micrometer, PTFE concentration:10%, and dispersion-medium:perfluoro pentane)] after cleaning washing, the self-aligning roller bearing (bearing number: 22311) shown in drawing 2 was seasoned naturally after that, and the coat of PTFE was formed.

Thickness was 1-5 micrometers. Subsequently, the building envelope of the bearing formed in JP,8-309793,A using the injection molding machine for oil impregnation polymer shaping of a publication with the floating guide ring at an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and the time was filled up with the thing of the following combination as a lubricant content polymer. Lubricant content polymer member: High density polyethylene 20wt% ultra high molecular weight polyethylene 5wt% polyethylene wax 5wt% mineral oil It was filled up with the above-mentioned lubricant content polymer member, without forming the coat of PTFE in the above-mentioned self-aligning roller bearing for 70wt% and a comparison.

[0017] About each self-aligning roller bearing obtained by the above actuation, the drum test (N=800rpm, Fr=280kgf) was performed, and outer-ring-of-spiral-wound-gasket outer-diameter temperature and bearing torque were measured. A result is shown in a table 1.

[0018]

[A table 1]

表 1

試験軸受	実施例	比較例
外輪外径温度 (°C)	4 6	6 2
軸受トルク (kgf ・ cm)	1 6	6 4

[0019] Since the coat of PTFE is formed in the front face of a rolling element, a family peripheral face, and the inner skin of an outer ring of spiral wound gasket in the bearing of an example so that clearly from the result of a table 1, it turns out that the part and lubricant content polymer of bearing do not contact directly, bearing torque becomes small compared with the bearing of the example of a comparison, and the temperature rise of bearing is also low suppressed by it. Moreover, since the coat of PTFE is formed also on the surface of the floating guide ring, the lubrication between the inner end faces of the rolling element with which the coat of PTFE is similarly formed is maintained at stability, and is considered that this has also led to reduction of bearing torque.

[0020]

[Effect of the Invention] Since the coat of a solid lubricant (is formed in the front face of a rolling element etc. the inner skin side of an outer ring of spiral wound gasket the family peripheral face side) at

least for each part of bearing according to this invention as explained above, the lubrication action of a solid lubricant is added to becoming equivalent to the clearance being formed between lubricant content polymers with each part of bearing by the thickness of this coat, and coincidence. Therefore, friction between about each part of the poor revolution of the bearing depended for the wear powder of a lubricant content polymer biting and attaching, and a lubricant content polymer and bearing also decreases, torque lifting and the temperature rise of bearing are also suppressed to the minimum, and the revolution of smooth \*\*\*\*\* can be maintained with low torque. Moreover, the lubrication stabilized to the lubricant released gradually by it and coincidence from a lubricant content polymer is also maintained. Moreover, it can produce also in the manufacture approach, without being able to form a solid lubricant coat by easy processing of leaving the suspension containing a solid lubricant after coating, and causing trouble to especially a routing, before being filled up with a lubricant content polymer.

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CORRECTION OR AMENDMENT

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[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law  
 [Category partition] The 2nd partition of the 5th category  
 [Publication date] February 13, Heisei 15 (2003. 2.13)

[Publication No.] JP,11-51066,A  
 [Date of Publication] February 23, Heisei 11 (1999. 2.23)  
 [Annual volume number] Open patent official report 11-511  
 [Application number] Japanese Patent Application No. 9-204726  
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F16C 33/66 A

[Procedure amendment]  
 [Filing Date] November 5, Heisei 14 (2002. 11.5)  
 [Procedure amendment 1]  
 [Document to be Amended] Description  
 [Item(s) to be Amended] Claim  
 [Method of Amendment] Modification  
 [Proposed Amendment]  
 [Claim(s)]

[Claim 1] Lubricant content polymer restoration anti-friction bearing characterized by the thing of said anti-friction bearing for which the coat of a solid lubricant is formed in the inner skin of an outer ring of spiral wound gasket, the family peripheral face, and the front face of a rolling element at least in anti-friction bearing which comes to fill up a lubricant content polymer in the space formed with an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and a rolling element.

[Claim 2] Lubricant content polymer restoration anti-friction bearing according to claim 1 characterized by the thickness of the coat of a solid lubricant being 0.1-100 micrometers.

[Claim 3] Lubricant content polymer restoration anti-friction bearing according to claim 1 or 2 characterized by a solid lubricant being polytetrafluoroethylene, MoS<sub>2</sub>, graphite, N-lauroyl L-lysine, h-BN, or graphite fluoride.

[Claim 4] The manufacture approach of lubricant content polymer restoration anti-friction bearing which is filled up with a lubricant content polymer in the space which forms anti-friction bearing in the inner skin of an outer ring of spiral wound gasket, and a family peripheral face list, forms the coat of a solid lubricant on the surface of a rolling element at least after assembly, and is subsequently formed with an outer ring of spiral wound gasket, an inner ring of spiral wound gasket, and a rolling element, and is

characterized by making it solidify.

[Claim 5] The manufacture approach of lubricant content polymer restoration anti-friction bearing according to claim 4 characterized by evaporating the dispersion medium of suspension and forming after bearing is immersed in the suspension which distributed polytetrafluoroethylene, MoS<sub>2</sub>, graphite, N-lauroyl L-lysine, h-BN, or graphite fluoride for the coat of a solid lubricant to the dispersion medium, or after spraying said suspension on a rolling-element front face at the inner skin of an outer ring of spiral wound gasket, and a family peripheral face list.

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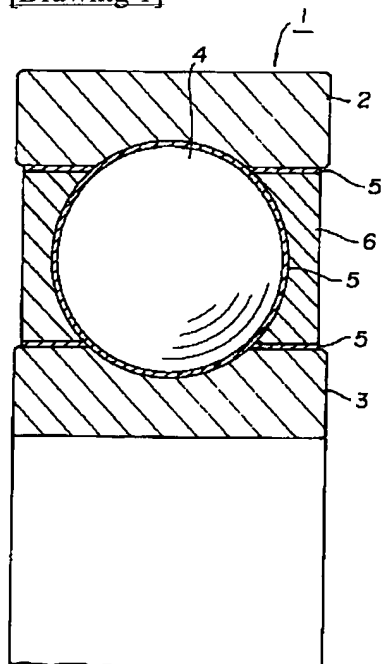
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DRAWINGS

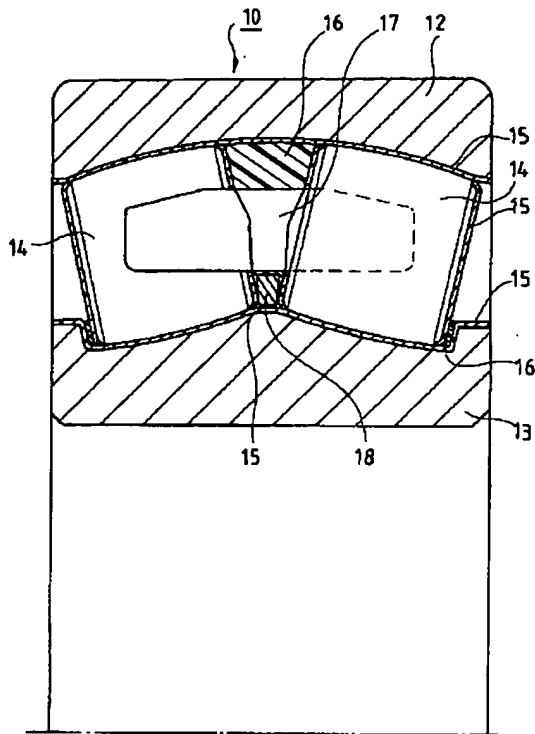
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[Drawing 1]



[Drawing 2]





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[Translation done.]